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METHOD OF BONDING SUBSTRATE AND DEVICE FOR THE SAME

[Abstract]

PROBLEM TO BE SOLVED: To provide a device for bonding two sheets of substrates with high accuracy as in a display panel.

SOLUTION: An upper surface plate height and swing and tilt position are regulated, with respect to the distance between the surface plates in bonding using sensors 8 and 10 for detecting the distance between the surface plates and actuators 9 and 11 for swinging and tilting the surface plates. A lower surface plate moving section 1 is activated in this position, and the horizontal direction of an upper substrate 4 and lower substrate 5 is positioned by cameras 2 and 7 at this position, by which the operation for aligning the clearance between the substrates can be carried out with minimal clearance state. The marks of the upper and lower substrates can therefore be

recognized with high accuracy, and since the clearance is small, the deviation by a mechanical error is the descending operation of the upper surface plate is mall and the bonding can be conducted with high accuracy.

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[Claim(s)]

[Claim 1] A substrate bonding apparatus for bonding two substrates comprising, a lower predetermined plate for adhering a lower substrate by suction, an upper predetermined plate for adhering an upper substrate by suction, a lower predetermined plate moving unit for moving the lower substrate horizontally, a camera for detecting a position of the lower substrate and the upper substrate, an upper predetermined plate elevation actuator for moving an upper predetermined plate in an upward and a downward direction, and in an elevation direction, a distance detecting sensor for detecting a distance between the lower predetermined plate and the upper predetermined plate.

[Claim 2] The substrate bonding apparatus for bonding two substrates as set forth in the claim 1, wherein in case of bonding, the distance between the predetermined plates are maintained constantly while the upper predetermined plate is elevated and moved by said predetermined plate elevation actuator and said distance detecting sensor, the lower predetermined plate moving unit is operated according to the information recognized by said camera, and the positions of the lower predetermined

plate and the upper predetermined plate are determined in a horizontal direction.

[Title of the Invention]

A SUBSTRATE BONDING APPARATUS FOR BONDING TWO SUBSTRATES

[Detailed Description of the Invention]

[Field of the Invention]

The present invention is related to a substrate bonding apparatus for bonding two substrates such as a display panel with a high precision.

[Description of the Prior Art]

FIG. 2 shows a structure of a conventional bonding apparatus. It is composed of a lower predetermined plate for adhering a lower substrate by suction, an upper predetermined plate for adhering an upper substrate by suction, a lower predetermined plate moving unit for moving a lower substrate horizontally, and a camera for detecting a position of a lower substrate and an upper substrate.

According to above-mentioned structure, the upper predetermined plate is lowered to the position where a gap of the lower and upper predetermined plate are formed. At the position, camera recognizes a reference mark attached on the lower and upper predetermined plate. A lower predetermined plate moving unit is moved in oder to be fitted with the

reference mark. The upper predetermined plate is lowered once again with being fitted within the reference mark. A position is set with a high precision by recognizing the reference mark by a camera again, and moving the upper predetermined plate moving unit while the lower and the upper predetermined plate are being contacted.

But, if a mark of the upper substrate and a mark of the lower substrate are recognized under the state that there is a gap, it is not possible to recognize the mark position with a high precision because of a focal depth of the focus. Further, if the gap is large, because of lowering operation of the upper predetermined plate, a mechanical error is generated, and thus a positional difference is generated. Further, even when an attempt to minimize the gap is made, parallel state between the upper and the lower substrate is not maintained and thereby a camera can not recognize. Further, in the contacting stage, there is a problem that it is difficult to perform an alignment with a high precision due to a friction force.

[Problem(s) to be Solved by the Invention]

In a display panel, a step for bonding the substrates with a high precision is required In order to improve the quality of a panel.

The object of the of the present invention is to perform a bonding with

a high precision while minimizing the gap between the substrates.

[Means for Solving the Problem]

In order to solve those problems, the present invention is composed of a lower predetermined plate for suction-adhering a lower substrate, an upper predetermined plate for suction-adhering an upper substrate, a lower predetermined plate moving unit for moving a lower substrate horizontally, a camera for detecting a position of a lower substrate and an upper substrate, an upper predetermined plate elevation actuator for moving an upper predetermined plate in an upward and a downward direction, and in an elevation direction, a distance detecting sensor for detecting a distance between the lower predetermined plate and the upper predetermined plate. The distance between the predetermined plates are maintained constantly while the upper predetermined plate is elevated and moved by said predetermined plate drive actuator and said distance detecting sensor, the lower predetermined plate moving unit is operated according to the information recognized by said camera, and the positions of the lower predetermined plate and the upper predetermined plate is determined in a horizon direction. Therefore, since a positional alignment can be performed with a gap between the substrates being minimized, the focus of mark

recognition of the power and the upper substrate exists within the range of a focal depth, thereby a high precision recognition can be realized. In addition, since the gap is small, the difference becomes very tiny due to the mechanical error generated by a lowering operation of the upper predetermined plate, and a high-precision bonding can be realized.

[Embodiment of the Invention]

The present invention is composed of a lower predetermined plate for suction-adhering a lower substrate, an upper predetermined plate for suction-adhering an upper substrate, a lower predetermined plate moving unit for moving a lower substrate horizontally, a camera for detecting a position of a lower substrate and an upper substrate, an upper predetermined plate elevation actuator for moving an upper predetermined plate in an upward and a downward direction, and in an elevation direction, and a distance detecting sensor for detecting a distance between the lower predetermined plate and the upper predetermined plate. In case of bonding, the height of the upper predetermined plate and the elevated position are adjusted by said upper predetermined plate elevation actuator, and said distance detecting sensor. At that position, the positions of the lower predetermined plate and the upper predetermined plate is determined in a

horizon direction by the camera if the lower predetermined plate moving unit is operated.

Since a positional alignment can be performed with a gap between the substrates being minimized, the focus of mark recognition of the power and the upper substrate exists within the range of a focal depth, thereby a high precision recognition can be realized. In addition, since the gap is small, the difference becomes very tiny due to the mechanical error generated by a lowering operation of the upper predetermined plate, and a high-precision bonding can be realized.

FIG. 1 shows an embodiment of the present invention.

(First embodiment)

FIG. 1 shows a structure of a bonding apparatus of the present invention.

In FIG. 1, 6 is a lower predetermined plate for adhering a lower substrate 5 by suction, 3 is an upper predetermined plate for adhering an upper substrate 4 by suction, 1 is a lower predetermined plate moving unit for moving the lower predetermined plate 6 horizontally, 2, 7 are cameras for detecting a reference mark of a lower substrate and an upper substrate, 9, 11 are upper predetermined plate elevation actuator for moving an upper

predetermined plate in an upward and a downward direction, and 8, 10 are sensors for detecting a distance between the lower predetermined plate and the upper predetermined plate. In case of bonding, the height of the upper predetermined plate and the elevated position are adjusted by said upper predetermined plate elevation actuator 9, 11, and said distance detecting sensor 8, 10. At that position, the positions of the lower predetermined plate 5 and the upper predetermined plate 4 are determined in a horizon direction by the camera 2, 7 if the lower predetermined plate moving unit 1 is operated.

A positional alignment can be performed with the gap between the substrates being minimized.

Further, as described above, even if two distance detecting sensors, and two predetermined plate drive actuators are used. But, generally, in most substrates, 3-4 sensors and actuators are used, and an elevation adjustment of a plane is performed.

[Effect of the Invention]

According to the present invention as described above, since a positional alignment can be performed with a gap between the substrates being minimized, the focus of mark recognition of the power and the upper substrate exists within the range of a focal depth, thereby a high precision

recognition can be realized. In addition, since the gap is small, the difference becomes very tiny due to the mechanical error generated by a lowering operation of the upper predetermined plate, and a high-precision bonding can be realized.

[Description of Drawings]

FIG. 1 shows a structure of a bonding apparatus of the present invention.

FIG. 2 shows a structure of a conventional bonding apparatus.